Mount Allan

Ski Area Master Plan

MOUNT ALLAN MASTER PLAN

SUMMARY INFORMATION DOCUMENT

MAY 1984

Alberta

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All figures and graphs in this document are direct reproductions of those prepared by Landplan and its members for the Mount Allan Masterplan commissioned by Alberta Tourism and Small Business.

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INTRODUCTION

The Alberta Government has monitored over a number of years the supply and demand for a variety of recreational and tourism opportunities in the province. On the basis of numerous studies, it was determined in 1981 that the government would support the development of a new recreational ski area in the Eastern Slopes of the Rocky Mountains to meet increasing skier demand and to enhance existing ski opportunities in the region. In the summer of 1981, a public advertisement was issued requesting that interested private sector developers for an alpine ski area submit their interest to the Alberta Government. A very positive response was received and the submissions were evaluated on the basis of overall capability to undertake a project of this nature. Six (6) potential developers were eventually prequalified to submit detailed development proposals.

Shortly after work had been initiated on proposed private sector development of a new day-use ski area, the Calgary Olympic Development Association (C.O.D.A.) requested the support of the Alberta Government in its bid to host the XV Olympic Winter Games in 1988. The Alberta Government made a commitment in September, 1981 to support C.O.D.A.'s bid. Primary commitments related to the development of capital projects, and this included the upgrading of an existing recreational ski area to Olympic competition standards.

On September 30, 1981, C.O.D.A. was successful in its bid and the XV Olympic Winter Games Organizing Committee (OCO'88) was formed to effect the actual staging of the Games. As one of its first undertakings, OCO'88 initiated a detailed process of determining the most suitable and feasible sites for hosting all Olympic events.

One of the important objectives in the site selection process was to ensure that not only would the site host high quality Olympic competitions, but it would also leave a legacy for Albertans; an economically viable ski area which would meet the needs of recreational skiers as well as training and competing athletes.

Following an extensive evaluation of all potential sites, OCO'88 announced on November 9, 1982 that Mt. Allan had been chosen as the site for the Olympic alpine events in 1988. The Alberta Government subsequently supported this decision.

Just prior to the site selection decision, the Alberta Government had issued a proposal call to the six prequalified developers for the development of the proposed recreational ski area.

In February, 1983, five development proposals were received, three of which proposed the development of Mt. Allan. Each proposal was evaluated in detail and the assessment indicated that none of the proposals were acceptable. All proposals fell short of making a firm financial commitment to support an economically viable recreational ski area.

On April 29, 1983 the Honourable "Boomer" Adair, Minister of Alberta Tourism and Small Business, reaffirmed the government's support for the development of Mt. Allan as an Olympic alpine venue and indicated that although private sector development and operation was the primary objective, if this could not be achieved, the province would proceed with development planning and continue negotiations with private sector for future involvement. The opportunity to integrate both recreational and Olympic requirements at one site was viewed as a positive attribute of Mt. Allan.

Even though private sector developer negotiations were still continuing, in order to meet Olympic commitments, it was decided that master planning for the project should be initiated in the fall of 1983 so that construction could be started in the summer of 1984. An open proposal call was issued and a master plan consultant was selected in October, 1983.

On December 29, 1983 the Alberta Government finalized its Olympic commitments and obligations through the signing of a legal agreement with OCO'88. One of the commitments was the Mt. Allan project.

The master plan was completed in April, 1984 and has received the endorsement of OCO'88, the Canadian Ski Association (C.S.A.) and the Alberta Government.

PURPOSE

The purpose of this document is to summarize the findings of the master plan process and to describe the proposed development of the Mt. Allan ski area.

LOCATIONAL PERSPECTIVE

Mount Allan is located approximately 90 km (56 miles) southwest of Calgary, Alberta, in the eastern ranges of the Rocky Mountains (refer to Fig. 1). The site for the ski area development is situated on the northern edge of Kananaskis Country, a major provincial year-round recreation area.

The Mt. Allan area is provincial crown land and forms part of the Marmot Creek Watershed Research Basin where research has been ongoing over 20 years and has afforded the planning team access to significant data on temperature, precipitation, wind, humidity and snowpack in the 9.4 km basin.

One of the requirements of hosting the Olympics is that athletes' housing be located no further than one hour's drive from the competition sites. Mt. Allan is within this driving distance.

OBJECTIVES

The first step in the master planning process was to establish and/or confirm the overall objectives for the project as these would form the basis for program development and provide a "measuring stick" for the evaluation of alternative plans and programs.

Three primary objectives were identified:

To provide a day-use recreational ski area for Albertans and visitors to Alberta;

To provide a suitable venue for alpine events for the 1988 Winter Olympics;

To provide a training legacy for competitive skiers in Alberta, and Canada.

Several more specific and program-related objectives were also identified:

To create an economically viable day use recreational ski area;

To effectively integrate recreational, training and competition requirements and uses on site;

To involve private sector in the development and/or operation of the Mt. Allan facilities;

To minimize any potential negative impacts on the environment, particularly as related to the bighorn sheep population;

To meet the short and long term needs of the Alberta skier market;

To complement and enhance the tourism and recreational ski opportunities in Alberta;

To complete the facilities in time to host the mandatory Olympic test competitions in 1986-87.

MASTER PLANNING PARTICIPANTS

In terms of meeting all of the basic objectives identified for this project and ensure that the best possible facility would be developed for the short term Olympic needs and the longer term recreational, training and competition needs, a steering committee of knowledgeable individuals, representing the broad interests of the project was formed. Key representation on this committee included:

1. OCO'88 - to provide input on the technical requirements associated with designing Olympic alpine competition runs as well as other festival specific requirements of hosting the Games. OCO'88 was also responsible for liaising with international sport governing bodies to ensure that planning and design was evolving in a manner consistent with their expectations for hosting the Olympics.

2. C.S.A. - to provide input on athlete training and competition requirements, more related to the period prior to and following the Games in 1988.

3. A private sector individual who had been extensively involved in the operation of ski areas, primarily in Alberta. Responsibilities related to providing input on general design and operational considerations to assist primarily with planning and designing the recreational component of the program.

4. Alberta Government departments which were assigned responsibility for the implementation of the Mt. Allan project. This included representation by the Chairman of the Special Committee for the Review of Wildlife and Environmental Matters, a special committee established to ensure that Olympic projects on crown land would be developed in an environmentally responsible manner.

Alberta Tourism and Small Business functioned as lead agency in terms of the recreational ski area development, including private sector developer negotiations. The Olympic Secretariat, Alberta Recreation and Parks assumed responsibility for the Olympic upgrading program. OCO'88's primary responsibilities relate to the staging of the Games and all of the festival-specific costs associated with same.

The consultants retained to complete the master plan were the Landplan Group. The Landplan Group is comprised of Landplan Associates Ltd. of Calgary, Alberta; Ecosign - Mountain Recreation Planners Ltd. of Whistler, B.C.,; and Arcop Thom Architects in association with the Calgary-based Peter Haley Architect. A variety of predominantly Alberta based firms with expertise in diverse fields were subcontracted by the Landplan Group to participate in the preparation of the Mount Allan Ski Area Master Plan.

PLANNING PARAMETERS

A number of planning parameters were identified on the basis of ski industry standards and knowledge and experience gained through the development and operation of existing ski areas within and outside Alberta.

Ski area development is generally considered to be a non-consumptive use of the land as skiers basically only take pictures and leave tracks in the snow. The development of ski lifts and trails requires the removal of approximately 20% of the forest canopy. Ski lift rights-of-way are characteristically 12-15 metres (40-50 feet) in width, while ski trails vary between 30 and 60 metres (100-200 feet) wide. Subsequent to forest removal, the ski trails require the removal of all stumps and debris and fine grooming and seeding to establish a grass cover which prevents erosion and minimizes hazards and damage to the skiers and the snow grooming equipment. Ski lifts are aerial cable systems used to transport skiers up the mountain with steel towers and concrete foundations every 50-80 metres. A standard forest access road is also required for lift and trail construction and the long term operation and maintenance of the mountain. Ski base area development generally includes a paved access road, gravel parking lots and buildings for a day lodge and maintenance centre. Additionally, appropriate power and water supply and sewage disposal facilities are required to support the base area improvements.

In addition to these basic ingredients of a ski area, it is fair to suggest that in recent years a new fundamental component has been added. Snow making capacity is presently being viewed as critical to the economic viability of a recreational ski area. It has been said that no new ski area in North America today would be developed without the capacity for snow making, and this trend has been evidenced through the tremendous increase in the number of existing ski resorts which are installing systems. Even in high snowfall areas, snowmaking is considered essential to ensure a full ski season and maximize revenues - especially during the critical Christmas/New Year period when ski facilities expect to generate up to 30% of seasonal revenue.

The decision to host the Olympics alpine events on Mt. Allan has added a new dimension to the base recreational ski area planning, design, construction and operational program. Of critical importance is the development of competition runs to host the Men's and Ladies' downhill events and the Men's and Ladies' slalom and giant slalom events. There are a number of technical standards and requirements which have been set down by the sport governing body for alpine skiing which must be adhered to. In addition, there are numerous temporary functions and activities which must be accommodated on site to successfully host the Olympic events. Part of the complexity of the planning program related to how the temporary and permanent ski requirements could be most effectively and economically integrated, without compromising the efficiency and viability of the commercial ski area.

The determination of an area's Skier Carrying Capacity (SCC) is perhaps the most critical step in ski area planning. This calculation represents the number of skiers per day which can be safely supported by an area's lift and trail systems while providing a quality experience to each skier ability level. SCC is determined via an integration of lift capacity, acceptable slope densities, slope gradients, skier skill classifications and vertical metres of lift-serviced terrain. Surveys conducted reveal that Albertans possess skier skill levels which closely approximate the bell curve distribution found in the general North American skier market. It should also be noted that machine snow is considered to be more durable than natural snow and therefore can sustain higher skier densities, with less wear and tear on the slopes.

Lift and trail systems should be designed to minimize congestion, crowding, conflict and worn-out snow conditions. Utilization of various lift loading and unloading patterns can direct skiers onto preferred trail systems to improve trail utilization and avoid major congestion areas. One of the most important considerations in the construction and operation of a successful downhill ski resort is the provision of a balanced lift and trail complex that approximates the experience levels of the supporting market area.

The base facilities at a ski area are the focus of recreational activity. The function, character, convenience and aesthetics of the base facilities all contribute to the skier experience. If the base area is a well planned and functional ensemble of facilities and activities, it could add greatly to the desirability of the ski area as a whole and increase the likelihood of return visits and growing market demand. Ski areas require a distinct spatial organization to effectively move visitors from the vehicular mode of arrival onto the ski slopes and up the mountain. The focal point is in and around the day lodge and functions must be carefully arranged both horizontally and vertically to maximize visitor enjoyment and area revenues while minimizing traffic congestion, visitor confusion and area management problems. The five functional zones identified are entry/arrival, primary services (tickets, restrooms, information), secondary services (retail, ski rental and repair, ski school, nursery, public lockers and change areas, food and beverage services), skier congregation (ski racks, posted information, sun decks, lift mazing area) and operational/service functions (area administration, staff lockers, storage and mechanical, kitchen, first aid, caretaker suite).

PLANNING PROCESS

A master plan is the first step in the development process and by its very nature identifies an individual site's opportunities and constraints and then focuses upon design to resolve issues and concerns identified during this process. The Master Plan is a tool to guide the development of Mount Allan and does not preclude the requirements for detailed design, engineering and architecture prior to on-site construction activities. As the ski area development proceeds through the detailed design and field layout stages minor changes to the Master Plan in terms of the site-specific placement of buildings, lifts, ski trails and utilities may occur within the prescribed development area boundaries. The Master Plan delineates the spirit and intent of the proposed Mount Allan development as it relates to recreational skiing, Olympic competition, competitive after use and the overriding mitigative measures required to implement the plan in an environmentally acceptable manner. The Mount Allan Ski Area Master Plan, therefore represents the integration of a variety of physical, ecological, financial and market considerations into design ensemble and interrelated facilities and activities.

A number of policy and public issues were identified prior to and during the planning process by way of public input, on-site investigations and preliminary design considerations. These issues related primarily to: climate; environmental quality; mountain and base area design parameters and concepts; Olympic courses and facilities; the integration of Olympic and recreational facilities; site access and infrastructure; and employee housing. While many of the issues were raised by the planning team and/or the Steering Committee, statements of public concern were also considered and incorporated into the Master Plan where applicable and feasible. Utilizing a combination of documented information and on-site investigations, the planning team generated design options and the associated costs, benefits and potential implications for consideration. The combined expertise of the Steering Committee and professionals possessing ski area planning and development experience were then utilized to identify the optimum solution based upon operational efficiency, cost and the maintenance of environmental quality.

The planning process for the proposed Mt. Allan ski area was a complex task which involved the following basic activities:

- The identification of all the factors which needed to be addressed to design a ski area for recreational and competition use;
- An inventory and/or analysis of each factor, including the identification of opportunities and constraints for development and operation;

- Issues identification and resolution;
- Program definition leading to the preparation of conceptual building and site development options including design layout;
- Detailed evaluation of program and design options;
- Development of capital cost estimates;
- Preparation of an operational and financial plan for the area;
- Preparation of an environmental protection plan for construction and operations;
- Development of an implementation strategy and schedule.

INVENTORY

Having identified all the requirements, factors and constraints which would have to be studied and/or addressed throughout the master plan process, including such things as specific Olympic requirements, market demand, physiography, environmental considerations, visual impact, infrastructure, land administration, climate, biophysical considerations, transportation, skier demand and trends, etc., a physical inventory of Mt. Allan was conducted.

The specific inventories described in this section all interact to determine the capabilities and suitability of Mt. Allan for the design and development of a recreational ski area and an Olympic site. Essentially this means identifying the best possible opportunities on the site to accommodate the various requirements identified. It also offers a means of identifying constraints to development and potential issues which must be resolved in order to successfully complete the project.

Inventories were undertaken on the following key subject areas:

1. Controlling Legislation and Policies:

   Land ownership and tenure, municipal government and services and other controlling legislation were examined in order to determine what opportunities and limiting factors there might be with respect to the proposed development program and its subsequent operation and management.

2. Physiography:

   The quality and feasibility of a winter sports site is highly dependent upon the topographic characteristics of each individual site. Physiographic features which substantially affect ski development include aspect (exposure), slope gradients, fall line patterns and elevation. Each of these features was investigated in detail.

3. Climate:

   Climatic conditions are extremely important to the operation and viability of a recreational ski area and also can represent a key factor in hosting the Olympic alpine events in 1988. The climatic conditions at Mt. Allan were addressed in detail during the site selection process and were deemed to be acceptable for the development and operation of a ski area. It was however recognized that snow making would have to be an integral part of the site in order to ensure a longer operating season, maximize revenues, and guarantee satisfactory snow conditions for the Olympics.

The primary focus of the climate studies in the master plan study was to assist with the planning, design and operation of the ski area. For example solar analysis assisted with the location and orientation of buildings so as to maximize the benefits of the sun. At the same time it was used to analyze the potential for shading on the competition runs during different times of the day. Winds were addressed in light of the lift locations, the effect of clearing on wind factors and the possible need for design modifications to mitigate any negative effects of the winds. In addition snow accumulation was mapped to assist with designing the specifications for a snow making system and temperature and humidity were examined for snowmaking and general comfort considerations. The final condition that was assessed was avalanche hazards, which could represent a possible development constraint and/or an operational consideration.

4. Biophysical Considerations:

Biophysical considerations relate not so much to the physical capacity of the site to be developed, but more toward the suitability of the site for development. Surficial geology and soils studies were conducted mainly to determine the construction suitability of different components of the project, and to identify areas unsuitable for development, mostly from a cost standpoint.

Hydrology of the area was examined, primarily to determine the effect of clearing on the watershed as well as the potential impact of snowmaking and the resultant snowmelt/runoff conditions.

Fisheries, vegetation, and historical/archaelogical resources were studied to determine whether significant resources existed, which should be preserved. Also, these resources were viewed in light of whether they offered opportunities which could enhance the site program.

Visual resources were considered to maximize the positive, and in some respects outstanding views from different points at the site, as well as to minimize the negative views from the highway and from within the site area.

5. Wildlife:

One of the most important considerations associated with the inventory was that of wildlife. The significance of the wildlife populations on the southwest side of Mt. Allan was identified at the time Mt. Allan was under consideration for development. Detailed inventories on wildlife in the Mt. Allan area were already available from government departments or in progress. Based on the fact that development of a

ski area was proposed for the northeast side of Mt. Allan, and other relevant considerations, it was felt that major impacts on the bighorn sheep would not occur due to the spatial separation. To ensure that there would not be any serious direct or indirect impacts on the sheep as a consequence of the development program, more detailed data on the specific Mt. Allan wildlife habitats and behaviour patterns was gathered and assembled and the results were mapped. The results of this study were used intensively in the preparation of programs, design, implementation strategies and operational and management plans for the ski area. In essence, the area has been designed so as to eliminate and/or minimize any potential negative impacts on the wildlife populations.

6. Off-Site Engineering Considerations:

Off-site engineering considerations included water, sewage, power and access. Inventory of these components focused on identifying existing and optional sources for supply and the capacity and/or feasibility of each source.

SUMMARY OF MOUNTAIN CHARACTERISTICS

The following discussion summarizes the significant information gathered and the conclusions drawn fron the inventory work completed.

Please note that working names have been assigned for unnamed physical features for ease of discussion and interpretation. Names are not official.

1. Land Administration:

   A substantial portion of the Mt. Allan Study Area (refer to Figure 2) lies within the Marmot Creek Watershed Research Basin where access and land uses are administered by Alberta Energy and Natural Resources in accordance with Alberta Order-in-Council #1480/71. The proposed Master Plan development area lies adjacent to the area being actively researched and does not conflict with the present monitoring activities. Municipal services in the Mount Allan area will be provided by the newly-formed improvement District No. 5, Kananaskis Country.

2. Physiographic Conditions:

   The proposed development area possesses predominantly northern and eastern exposures which are suitable for ski development as the slopes lie in the lee of prevailing winds and are well protected from the effects of solar radiation. The area possesses an almost ideal mix of ski terrain with natural slope gradients in the 15 to 60 percent range up to tree line where the slopes steepen sharply to 70+ percent up to the Ribbon Ridge and Mount Allan summit areas. The slope gradients are such that skiers can be naturally segregated into zones based on the various ability levels, thus minimizing potential skier conflicts. The natural drainage patterns break the area up into five major development zones with natural fall-line patterns highly conducive to good ski development. With the exception of the slopes lying to the northeast of Marmot and Cabin Creeks, all terrain within the study area eventually focuses upon the potential base lands at the 1525 meter (5,000 feet) elevation. Elevations within the study area range from the Kananaskis River Valley at 1,425 metres (4,675 feet) up to the summit of Mount Allan at 2,832 metres (9,290 feet). The proposed development will likely be concentrated between the base area at 1,495 metres (4,905 feet) and the tree line at 2,350 metres (7,710 feet), for a potential skiable vertical rise of 855 metres (2,805 feet). It appears feasible to ultimately develop lift-serviced skiing up to the 2,535 meter (8,317 feet) elevation for a potential skiable vertical rise of 1,110 metres (3,642 feet) thus giving Mount Allan the largest vertical rise in Alberta. Mount Allan has elevation differentials which are more than adequate to meet the 800 metre (2,625 feet) minimum vertical rise requirements for Olympic competition.

Study Area / Land Program

3. Climatic Conditions:

Climatic conditions on Mount Allan, particularly within the Marmot Creek Watershed Basin, have been closely monitored over the last 20 years as a component of scientific research activities. Five new weather stations were established on the development area in December 1983 to record temperature and wind speed and direction. Winters are characterized by cold, dry, rather still periods alternating with periods of comparatively warm, dry, windy Chinook conditions. Long-term records for the Kananaskis Ranger station near the base of Mount Allan show the mean daily temperature for January, the coldest month, to be -12.0 degrees Celsius while the warmest month is July with mean daily temperatures of 13.2 degrees Celsius. Temperatures and precipitation vary considerably with elevation, aspect and slope. Mean annual precipitation on Mount Allan varies from 660 mm (26 in.) in the lower elevations to over 1140 mm (45 in.) in the upper reaches of Twin Creek.

The mean annual precipitation for Marmot Creek Basin is 895 mm (35 in.), 50 to 75% of which falls as snow. Mean annual snowfall at Mount Allan ranges from 264 cm (104 in.) on the valley floor to 605 cm (238 in.) in the upper elevations. The natural snowfall at Mount Allan compares favourably with the mean annual snowfalls at Banff (251 cm); Jasper townsite (152 cm) and Lake Louise (418 cm). Five major snowpack accumulation zones have been mapped within the study area; low, moderate, high, very high and alpine. The low accumulation zone occurs on the lower mountain slopes which are susceptible to snowpack ablation by Chinook winds during December and January. Since the low accumulation zone has a mean snow depth of 56 cm (22 in.) in late March, an extensive snowmaking system is recommended on the lower mountain to ensure quality ski conditions from early November through April. Temperature and humidity conditions are excellent for the efficient production of machine snow.

Potential avalanche hazards on Mount Allan have been mapped and analysed and have been determined as low and controllable. An effective avalanche control program can manage these hazards to ensure the maximum safety margin for skiers.

Wind is a significant climatic influence in the Alberta Rockies and hence may dramatically influence the design and layout of ski lifts, trails and competitive courses. During the winter months the synoptic flow pattern is from the west with southwesterly and northwesterly flow also occurring frequently. Strong, gusty winds occasionally occur along the summit ridge areas on Mount Allan due to the accelerating influences of the surrounding topography. The peak hourly average wind speed for the winter data available was near 97

km/hr (60 mph) at an exposed alpine station. While gusts in excess of 100 km/hr can interrupt safe lift operations, detailed on-site investigations of air flows, snow accumulation and vegetation suggest that the proposed ski development is very well sheltered from high winds. A three-dimensional computer wind model was utilized to forecast surface wind speed and direction under nine different flow conditions. The computer modelling strongly corroborates the field investigations which revealed no wind throw (blowdown) or weather vaning of the site's vegetation. Certain areas above tree line are susceptible to high winds and the resultant scouring of the snowpack. The design of lifts, trails and building locations has judiciously avoided potential wind scour areas and capitalized on the site's topographically protected areas.

4. Biophysical Conditions:

The soil conditions over the majority of the site are favourable for ski area development with a glacial ground moraine (till) deposit predominating. The depth to bedrock is relatively consistent across the site ranging from 4 to 7 metres (13 to 23 feet). Localized areas of potentially unstable slopes, rock bands, seepage areas and organic deposits have been mapped and largely avoided through careful design. The soils and depth to bedrock are very suitable for the fine grooming and recontouring of ski trails and perhaps more importantly the burial of snowmaking pipes and electrical distribution lines.

The proposed Mount Allan ski area lies, in part, within the Marmot Creek Experimental Watershed Basin, which has produced valuable water quantity and quality data for use in the planning and design process. The watershed contains three main creeks: Cabin Creek which was 50 percent clearcut in 1974, Middle Fork Creek (Marmot Creek) which remains as a control, and Twin Creek which was 40 percent cleared between 1977 and 1979. Between 85 and 95 percent of the total runoff in any given year and virtually all of the suspended load carried by the major stream channels occurs during the period May through September. Flows in the basin during the late fall and winter months are usually very low but steady.

Detailed analysis and mapping of the site's vegetation and forest cover has been prepared delineating three primary forest zones. The Alpine zone has eleven vegetation community types which include four rare and five endangered plant species although these are found above the proposed development areas. The Subalpine Forest Zone (2,150 to 2,300 m elevation) is characterized by the dominance of the coniferous tree species subalpine fir, white spruce, alpine larch and lodgepole pine. These conifers are largely overmature with stand heights ranging from 12 to 18 meters. On the lower mountain (1,525 to

2,150 m), two major forest types predominate. A mature mixed spruce-fir forest with some pine covers the area north of Gold Creek with stems ranging from 18 to 24 metres high and a 50 to 70 percent crown density. A 48 year old stand of dense lodgepole pine covers most of the study area south of Gold Creek. The pine replaced the mature spruce-fir forest destroyed by fire in 1936. The roads constructed for the salvage logging operation remain today in addition to roads built for mining and the watershed research. Since the Galatea fire in 1936 was quite hot, the upper soil layers were virtually sterilized, thereby removing essential nutrients. A pre-commercial thinning and forest fertilization program is recommended in this lodgepole stand to ensure forest vitality.

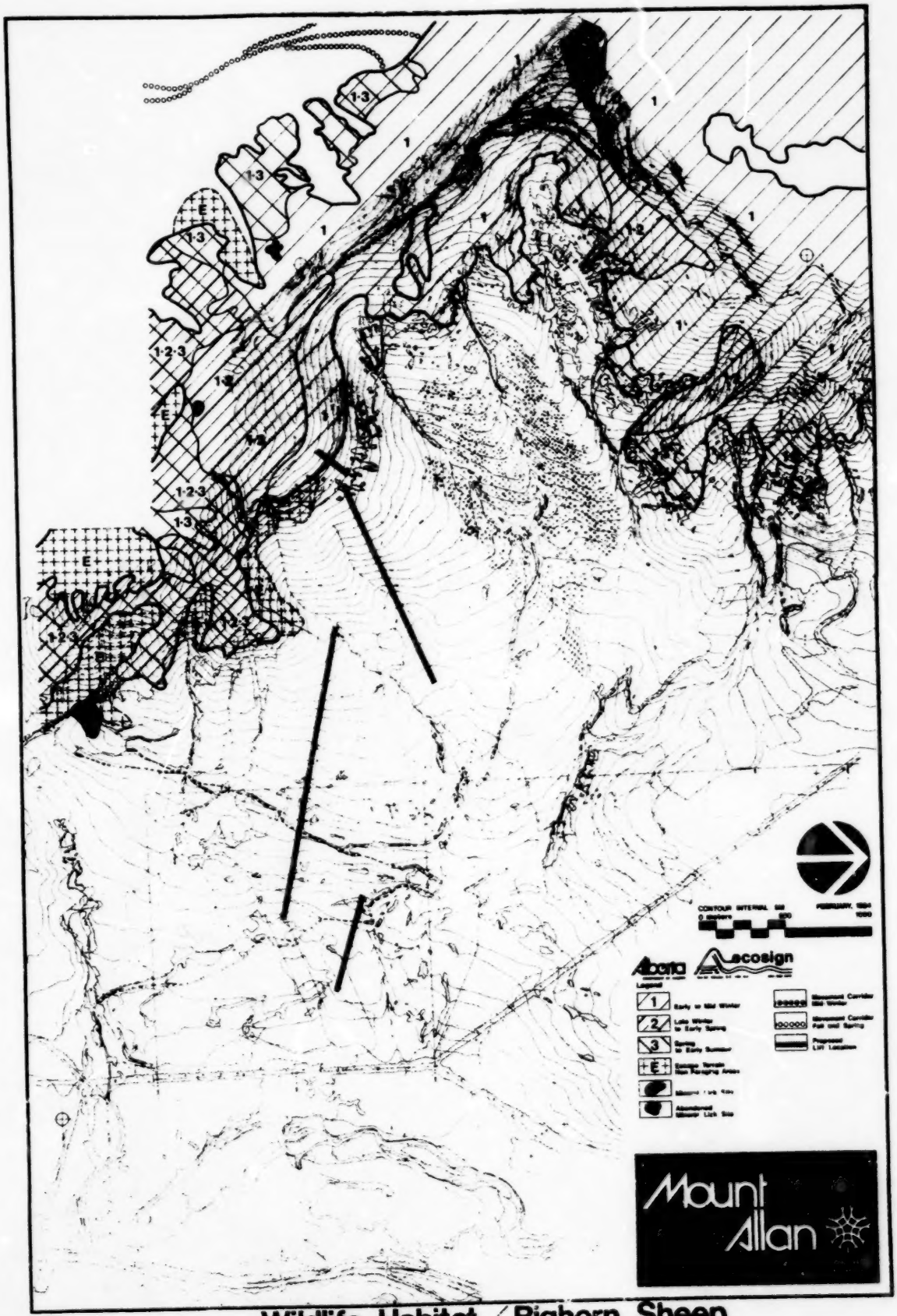
5. Wildlife:

The information available from government departments, in scientific literature and the Consultants' experience indicated key species for which there are potentially significant impacts. These key species are Rocky Mountain bighorn sheep, elk and grizzly bear. The nature of any impacts will depend upon the timing, duration, source and intensity of the disturbance. While other species are present in the study area, the numbers involved, the known sensitivity of the species to disturbance and the available habitat do not appear to justify the same level of concern as bighorn sheep, elk and grizzly bear.

The majority of sheep habitat for the critical winter and spring seasons lies on the south and southwest facing slopes of Mount Allan (refer to Figure 3). The summer period is a time of unlimited habitat availability and occurs roughly from late June through September. The north and east facing slopes of Mount Allan proposed for ski development are not valuable winter habitat for bighorn sheep. The Alpine Zone possesses snow cover, forage and escape terrain characteristics which make portions valuable as bighorn sheep habitat on Mount Allan during certain periods of the year. In general, the planning team considered the requirements of sheep (southwest, snow-free slopes) to be mutually exclusive of the features desired for ski development and hence areas deemed potentially valuable for sheep were deemed inappropriate for ski development.

Elk are regularly observed in the study area in winter but not as frequently as on other winter ranges in the vicinity (Wind Ridge, Pigeon Mountain). The main area of concentration appears to be the southwest slopes of Mount Allan near timberline. As with the bighorn sheep, the critical elk habitat components do not conflict spatially with the area proposed for ski development.

The majority of the reports of sightings and signs of grizzly bears are on the southwest slopes of Mount Allan. While the prime grizzly habitat areas do not conflict directly with the proposed ski development, potential denning areas have been identified in upper Marmot Basin within the proposed ski development area.



Wildlife Habitat / Bighorn Sheep

6. Off-Site Engineering Conditions:

One of the advantages of Mt. Allan with respect to development is its close proximity to existing infrastructure and services. A sewage treatment plant has been developed in Kananaskis Country and is located in proximity to the proposed ski area. The excess capacity of the sewage treatment plant is adequate to meet the needs of the proposed ski area, particularly as peak demand for other facilities on the system occurs during the summer months.

Water requirements for the Mt. Allan ski area are fairly substantial. Snow making and potable water and fire flow requirements are estimated at 22,000 litres (4,839 Imperial gallons) per minute for average operation. The Kananaskis River and associated aquifer are the only sources capable of supplying water for this project. The amount of water held in storage in the aquifer is calculated to be 9.5 billion litres. On an annual basis, ski area requirements should be equivalent to less than 2.5% of the aquifer water, 85% of which would be recycled into the Marmot Creek drainage basin during the spring runoff period.

The Trans-Canada Highway, in conjunction with Highway 40 provides all-weather access to within 2 kilometres of the Mt. Allan site.

Energy supply requirements are relatively high, primarily due to snow-making requirements. Options reviewed included electrical power, natural gas and diesel. Detailed investigations on the most economical and feasible source of energy have not been concluded at this time.

MARKET ANALYSIS

A market analysis was undertaken to evaluate the historic demand and supply relationships within the local and regional skier markets and forecast Mt. Allan's position within the context of the current and planned alpine winter sport facilities. The market analysis was used to assist with establishing design parameters and to provide a basis for undertaking the necessary financial analyses on the project.

There are currently 14 ski areas within Mount Allan's local and regional market areas which received 1.71 million skier visits during the 1982/83 season. Skier visitation at the five downhill ski areas in the Alberta Rockies grew at a compound annual rate of 13.1 percent between 1965 and 1981, while installed capacity grew at a rate of 8.6 percent. While skier visitation has declined during the past two seasons at the Banff areas due to poor snow and economic conditions, similar occurrences recorded in other market areas suggest that the growth trends will be restored as favourable conditions return. A series of three demand (skier visits) and supply forecasts have been generated utilizing low (2.4%), mid (5.4%) and high (8.4%) compound annual growth rates. Expansion of existing areas can only meet the low demand forecast with substantial 1990 capacity deficits of between 4,500 and 23,335 skiers per day for the mid and high estimates. If developed to the 4,000 skiers per day capacity level, Mount Allan will contribute 10 percent of the regional ski area capacity and hence should capture approximately 10 percent of the market. Assuming an initial capacity of 4,000/day, a 140-day season and a 45 percent untilization rate, it is estimated that the Mount Allan project should receive approximately 252,000 skier visits.

The Mount Allan project's favourable terrain, access and guaranteed snow conditions should ensure the realization of at least its fair market share and based on projected visitation, should ensure the economic viability of the area.

The hosting of the Olympic alpine events in 1988 should also enhance the market attraction of the site.

SITE DEVELOPMENT ANALYSIS

The purpose of the development analysis was to blend the information and/or constraints identified during the inventory stage with acceptable ski industry planning parameters for both the mountain and base area. Specifically, the constraints imposed by climate (natural snowpacks, winds), wildlife (habitat and movement corridors), surficial geology (depth to bedrock, potential hazards, high water table) and vegetation (tree species and heights) have served to define the practical and acceptable limits for development and determine the design modifications necessary to meet the site specific needs of Alberta skiers on Mt. Allan.

a) Mountain Design Analysis:

Two critical analyses were undertaken to assist with ski area design and provide an added basis for the evaluation process. A Fall-Line Analysis Map (refer to Figure 4) was prepared which delineates major drainages, fall-line patterns and primary and secondary fall-line concentration areas. The primary concentration areas suggest potential lift terminal locations and hence suitable base facility locations. Secondary concentration areas suggest trail intertie points. Mt. Allan was determined to have fall-line patterns extremely conducive to recreational ski development. A Ski Area Slope Analysis Map was also prepared which delineates the areas that can be negotiated by the various skier ability levels as well as the areas which are too flat or too steep for the skiing public. The natural slope gradients were measured and coded according to the following classification.

Slope Gradients	Type of Skiing
0 - 8%	flats, marginal skiing
8 - 25%	beginner & novice skiing
25 - 45%	intermediate skiing
45 - 70%	advanced & expert skiing
70%	unskiable, safety zones

The Fall-Line and Slope Analysis maps were utilized in the evaluation of the terrain and formed part of the criteria for trail and lift placement.

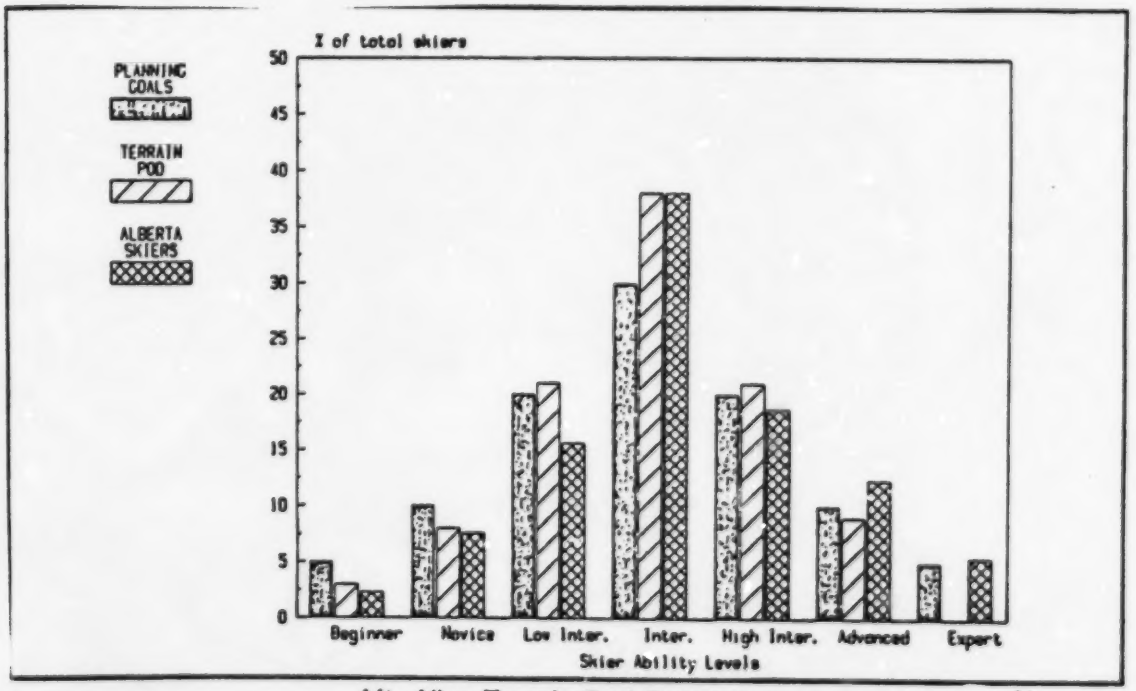
b) Terrain Capacity Analysis:

The overall ski development potential of the Mt. Allan site was analyzed through a process of synthesizing information generated from the various inventories and analyses undertaken as well as observing the following criteria:

Fall Line Analysis

- continuous fall-line skiing from top to bottom
- suitable upper and lower lift terminal locations (e.g. .5 acres less than 25% slope)
- good slope continuity to allow interesting skiing from top to bottom for one or more skier ability levels
- natural slope gradients primarily greater than 8% and less than 70%
- avoid areas with marginal snow and/or wind scour
- avoid spatial conflicts with critical wildlife habitats

A Terrain Capacity Analysis Map was prepared which outlined the most suitable areas for lift and trail development, based upon the above considerations. Potential is shown in the form of terrain pods and each pod is described as to specific development potential and the lift capacity necessary to serve the terrain within each pod. The terrain capacity analysis also provides an indication of the general balance of the developable terrain. The Mt. Allan Terrain Pod Balance chart is provided below and shows that the natural ski terrain is nearly perfectly balanced to the Alberta skier market.



Mt. Allan Terrain Pod Balance

The Mount Allan terrain capacity analysis had revealed eight terrain pods suitable for ski development encompassing 1,008 hectares (2,491 acres), some 44 percent of the total study area. To meet the objective of a 4,000 skier capacity, three terrain pods will be developed.

The natural terrain balance closely approximates the bell curve distribution of skier skill classifications with a slight weighting towards the intermediate terrain class. The potential development areas possess exposures within the northeast and southeast quadrants of the compass and hence are eminently suitable for alpine ski development.

The proposed base lands encompass an area of over 40 hectares (100 acres) and can provide services and recreational opportunities within a comfortable skier walking distance of 300 m. (984 ft.)

SKI FACILITY DEVELOPMENT PROGRAM

With the aid of the inventory and analysis work done and on-site investigations, various alternative site plans for the mountain were prepared. Each alternative was then evaluated according to a detailed set of criteria. One mountain plan evolved as best meeting the overall objectives of the proposed Mt. Allan ski area. The proposed plan is shown in Figure 5 and is described in the following sections.

The Mountain Master Plan proposes the installation of two fixed grip triple chairlifts and one fixed grip double chairlift with a combined capacity of 5,360 persons per hour (refer to Fig. 6). A large, glacial terrace at the 1,525 meter (5,000 feet) elevation was recognized as the most logical site for base area development due to available development terrain and fall-line patterns.

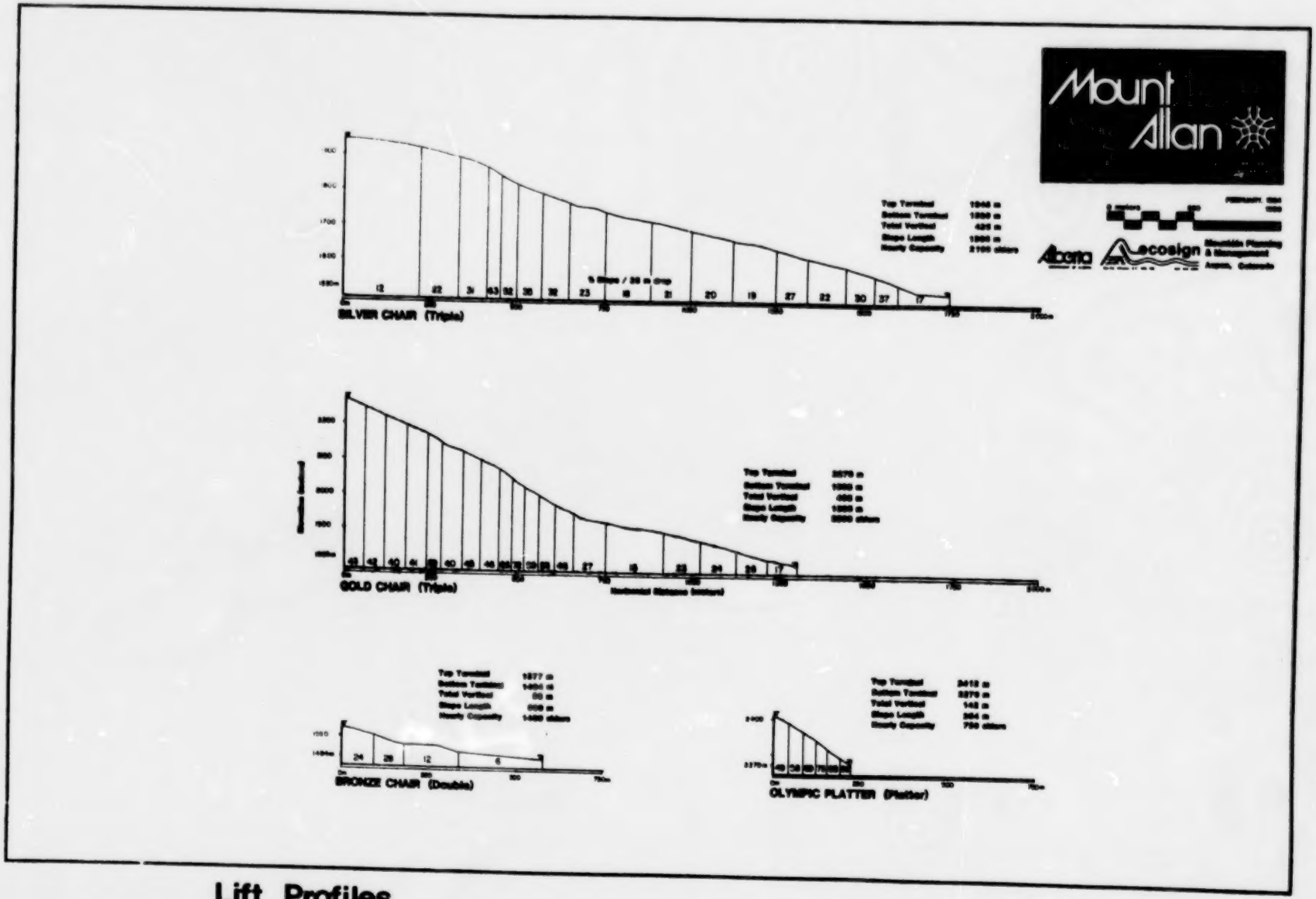
"A" Chair is a 2,160 pph triple chair which rises from the proposed base area 425 vertical metres to a large level bench at the 945 metre elevation just south of Gold Creek. "A" Chair services 8 major ski trails covering 40 hectares (100 acres) of intermediate and advanced terrain as well as 400 vertical metres of the proposed training area. "B" Chair is situated north of "A" Chair with the lower terminal accessible via two trails from the top of the "A" Chair. "B" Chair is a 2,000 pph triple chairlift rising 465 vertical metres to the tree line at the 2,270 metre elevation. "B" Chair services 18 major advanced intermediate, advanced and expert ski trails covering 55 hectares (136 acres). Since most of the "A" Chair trails are accessible from the "B" Chair trails, the Mountain Master Plan affords a variety of top-to-bottom continuous fall-line ski routes with a total vertical descent of 750 metres (2,460 feet).

"C" Chair is a 1200 pph fixed grip double chairlift situated at the northern extremity of the proposed base area. "C" Chair services 83 vertical metres of beginner and novice terrain covering 8 hectares (20 acres). "B" Chair effectively isolates beginner and novice skiers from potential traffic conflicts with more advanced skiers and facilitates easy movement within the base area.

Two on-mountain warming facilities are proposed due to Mount Allan's large vertical rise and periods of temperatures when signifcant wind chill factors can be expected. A small emergency shelter is proposed at the top of the "B" Chair in a common structure with ski patrol facilities. A 6,800 square foot mid-mountain facility is proposed near the lower terminal of the "B" Chair with basic food service and lounge facilities.

Mount Allan has been designed as a recreational day-use ski area which can comfortably accommodate 4,030 skiers per day. A mountain complex of 30 major ski trails with a combined length of 23 km has been designed to complement the proposed lift installations. The 30 recreational ski trails cover a total of 103 hectares (255 acres) and are perfectly balanced to the skill levels of the skier market.

Mountain Master Plan



Lift Profiles

Since very few sites in Alberta possess natural snowpacks suitable for downhill skiing in the early winter, an extensive snowmaking system has been proposed to provide an early ski season opening and to guarantee suitable conditions for the hosting of the 1988 Olympic Winter Games. The Master Plan calls for snowmaking on 20 of the 30 proposed ski trails. The Master Plan proposes to cover 66.11 hectares (163.36 acres) of recreational trails, 18 hectares (44.5 acres) of coverage for the Olympic venues and an additional 8.41 hectares (20.8 acres) for the training area for a total of 92.45 hectares (228.7 acres). Assuming that the special coverage needed for the Ladies' Downhill, Slalom and Giant Slalom events are later used by recreational skiers, the recreational ski area will possess a total of 78 hectares (193 acres) of snowmaking coverage which is just under 76 percent of the total trail system.

The combination of a machine snow base to cover natural hazards normally present at ski areas without snowmaking (i.e. rocks, stumps, bare patches), with a natural snow skiing layer on top will provide excellent ski conditions, particularly in the early season. Snowmaking systems are now considered an essential ingredient to economically viable ski resort operations to provide guaranteed early season skiing with quality conditions. Machine snow will support greater "wear and tear" on ski trails than natural snow, and offers a ski area the opportunity to generate higher levels of ski trail utilization, particularly in years where natural snowfall is lacking. The addition of a snowmaking system will allow Mount Allan to open in early to mid-November, and will likely allow for late season closing in May. This could trigger additional new skier demand by increasing the supply, opportunity, and quality of ski facilities in Alberta.

The snowmaking system is also an important element for Olympic alpine ski racing and competitive after-use of the ski area. Snowmaking will guarantee that ski racing events can be held as scheduled, and that course conditions will be more consistent for racers than natural snow conditions.

Ski racers in Canada now have to travel to the U.S. or Europe for pre-season training. Mount Allan will provide the only designated mountain training facility with snowmaking in Canada, and should attract racers from throughout the country. More importantly, both training and competition can occur at Mt. Allan without interfering with the recreational ski area operation.

BASE AREA DESIGN ANALYSIS

An analysis of the baselands of Mt. Allan was undertaken to identify development opportunities and constraints. The proposed base area is situated on benchlands above the escarpment overlooking the Kananaskis Valley. Existing topography was analyzed and slope gradients were coded according to the following categories:

Slope	Development Suitability
0 - 8%	parking, day lodge
8 - 15%	terraced parking, day lodge
15 - 30%	unsuitable for some development
30 - 40%	unsuitable for most development
40%+	unsuitable for development

Biophysical conditions were examined and limited constraints related to shallow bedrock and organic deposits were identified in certain portions of the base area. Vegetation and wildlife components did not pose any constraints.

The siting, design and orientation of the base area and buildings were evaluated on the basis of several criteria such as skier walking distance, visual aesthetics, solar conditions, ski lift locations and loading zones, ease of organization and circulation, grading requirements and many other physical and social factors.

Functional space requirements associated with hosting the Olympics were also assessed to determine how many of these functions could be met within the base area. In addition, functional relationships between Olympic activities were addressed so as to facilitate the design process. Olympic functions include a race headquarters, a jury room, a minor officials room, team leader meeting rooms, cafeteria for athletes and officials, first aid and doping room, communications room, a room for results network equipment, etc.

BASE FACILITY DEVELOPMENT

The base area development concept includes provisions for access, parking and day lodge and maintenance facilities. The day lodge has been sited on a slight prominence to separate parking from skier activities. Functional building programs have been developed for the public base facilities. Two adjoining structures are proposed to accommodate day lodge requirements. Building functions have also been examined in light of the temporary Olympic requirements and the spaces appear suitable to meet these needs as well as the functional requirements associated with on-going training and competition uses.

Parking stalls for 1,400 vehicles is proposed within 300 metres of the day lodge. Parking for buses has been segregated from automobile parking to minimize conflicts. Parking and circulation have also been discussed with the festival-specific requirements of the Olympics in mind and is expected to adequately accommodate these transportation needs.

The maintenance and snow-making compound is situated on a lower terrace to the east of the day lodge, providing access for both rubber-tired vehicles and snow grooming equipment, while remaining visually unobtrusive. Figure 7 illustrates the conceptual base area site plan.

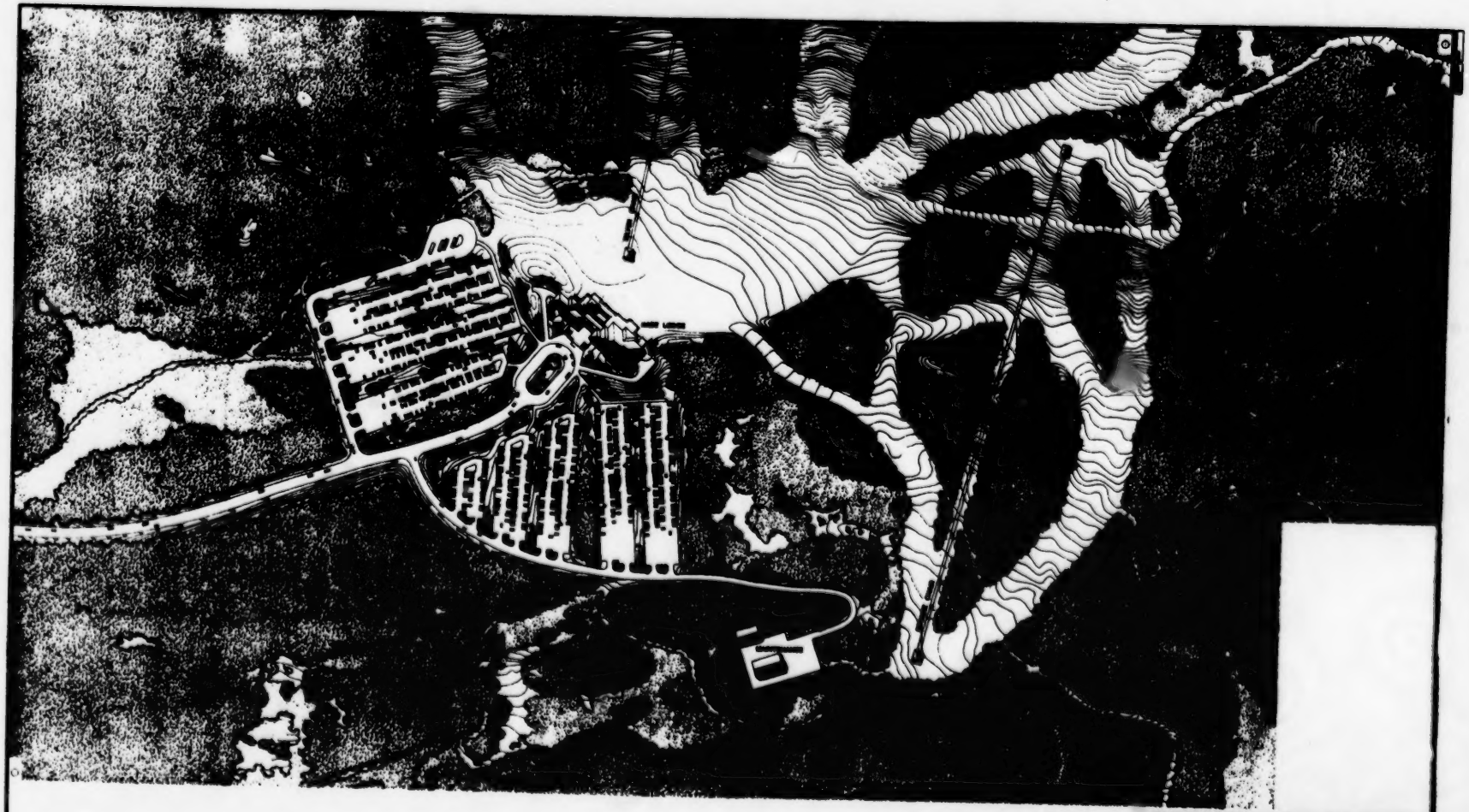
INFRASTRUCTURE

Water requirements for domestic use, fire protection and snowmaking will be supplied from the Kananaskis River and associated aquifer by means of subsurface extraction. Snowmaking will be accomplished with a combined compressed air-water and airless system covering a total of 92.45 hectares (228.7 acres) of ski trails.

Sewage from the mid-mountain facility, day lodge and maintenance compound will be collected by a conventional gravity system and pumped to the existing Kananaskis Sewage Treatment Plant.

Options for supplying power to the site are currently being reviewed with suppliers to determine the most feasible and economic methods both in terms of capital and on-going operational costs, including snowmaking.

Access to the base area will require approximately 1.8 km of new road construction to link the ski area to the Ribbon Creek Village access road and Highway 40. Roadways will be designed to acceptable standards and will be paved. Parking areas will be gravelled. Existing tree cover along the access road and adjacent to parking areas will be preserved wherever possible. A total of 5.0 km of mountain access and construction roads are required. Mount Allan will be the most conveniently accessed Rocky Mountain ski area in Alberta for day use alpine skiers.



Base Area - Site Plan

Mount Allan

OLYMPIC REQUIREMENTS

During the period of February 14th to the 28th, 1988, Mt. Allan will be the site for hosting the Olympic Alpine events. The following events are scheduled:

Men's	Ladies'
Downhill	Downhill
Giant Slalom	Giant Slalom
Slalom	Slalom

In addition OCO'88 has recently had freestyle skiing approved as a demonstration sport and this event may also be hosted on Mt. Allan. A brief description of the FIS (Internationale Federation de Ski) technical requirements for the downhill, giant slalom, and slalom disciplines is provided below. The FIS is the international body governing alpine ski racing.

Summary of FIS Technical Requirements

	DOWNHILL		GIANT SLALOM		SLALOM	
	Mens	Ladies	Mens	Ladies	Mens	Ladies
Vertical Rise						
Maximum	1000 m.	700 m.	400 m.	350 m.	220 m.	180 m.
Minimum	800 m.	500 m.	300 m.	300 m.	180 m.	130 m.
(exception case)	(750 m.)					
Slope Distance	3.4 km.	2.5 km.	-	-	-	-
Average Slope (800 - 1000 m.)	24 - 31%	20 - 28%	-	-	33 - 45%	33 - 45%
Steepest Slope	-	-	-	-	52%	52%
Flattest Slope	-	-	-	-	33%	33%
Minimum Elapsed Time	+2:00:00	+1:40:00	-	-	-	-
Slope Width	30 m.	30 m.	30 m.	30 m.	40 m.	40 m.
Gate Width	+8 m.	+8 m.	4 - 8 m.	4 - 8 m.	4 - 5 m.	4 - 5 m.

Additional on-mountain facilities required for the Olympics included portable start and finish buildings and sufficient area to locate temporary requirements such as spectator bleachers, warming shelters, food/beverage concessions, media trailers, team trailers, washrooms, etc.

Spectator access to the base of the proposed finish areas had to be addressed in light of the magnitude of spectators normally attracted to downhill racing events. OCO'88 is responsible for transportation matters related to staging the Games, but the master plan process identified opportunities and constraints in this regard to assist OCO'88 with developing its transportation plans.

OLYMPIC FACILITY DEVELOPMENT

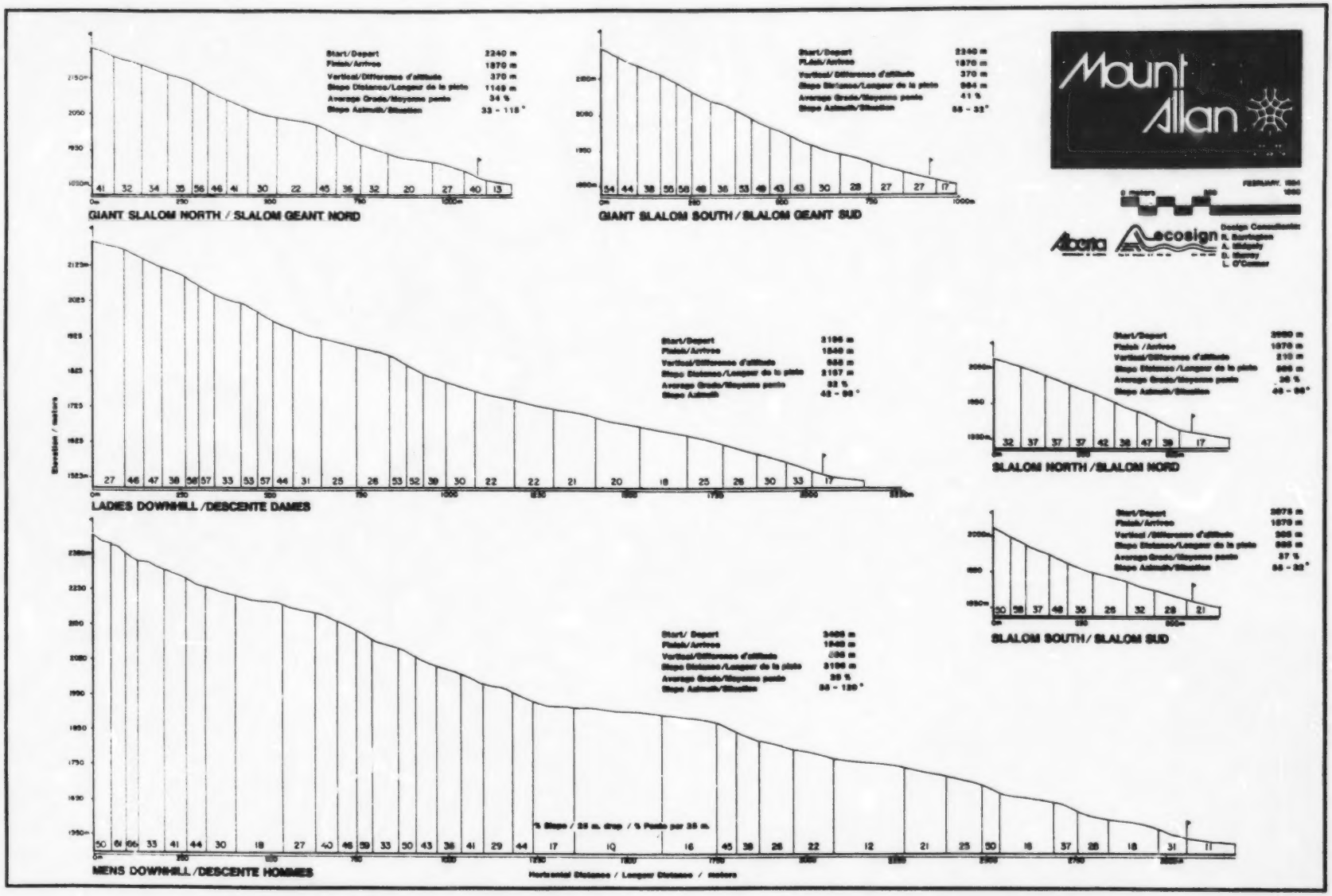
The technical course requirements for competitive alpine ski racing as well as facilities for officials, media and spectators can be met with the base area and mountain master plan. A combination of permanent and temporary facilities will be provided for staging the Olympic Games. Permanent facilities are those which are an integral component of the recreational skiing facilities and the proposed training and competitive after-use of Mt. Allan. There is adequate room to locate all anticipated temporary requirements and these will be removed after the Games. Due to the nature of the steep upper terrain on the men's downhill course, a surface lift will be required extending from treeline to an area below the top of Ribbon Ridge, to provide competitor access to the start of the men's downhill run. This lift is proposed as a temporary installation to meet the needs of the Olympics and will be dismantled following the Games.

The CSA, FIS, OCO'88 and other recognized members of the skiing community assisted with locating the best possible competitive courses on Mt. Allan. At present all courses meet the FIS technical requirements and have been judged to be satisfactory by OCO'88 and CSA officials. The Calgary Olympic Winter Games will also provide long term competitive training facilities on Mt. Allan which would not normally be provided in a recreational ski resort. Due to layout of the mountain facilities, it has been possible to designate a training run which will not conflict with the recreational ski trails. Additionally, snow making coverage has been expanded over what normally would be provided to ensure a guaranteed high quality snow base on all Olympic ski racing courses and the designated training run.

The proposed Olympic course locations are illustrated in Figure 8. Course profiles and technical specifications for these proposed courses are shown in Figure 9. Given the current alignments and lift systems, an acceptable crossing of the Men's Downhill will be required to allow competitors and officials to gain access from the top of "A" chair to the bottom of "B" chair. OCO'88 is presently investigating this requirement and options available to them.

While all courses meet the FIS technical requirements, preliminary course homologations are not expected to occur until the winter season when snow is on the cleared trails. It is expected that further changes will be made in the course locations and routing. This modification process is very much a part of designing and constructing ski runs of this calibre, and minor modifications may occur right up until 1988. Final approval of the courses by the FIS will not be given until homologation has occurred and the Federation agrees that the courses are satisfactory.

Mountain Olympic Facilities Plan


Mount Allan
GIANT SLALOM NORTH / SLALOM GEANT NORD
GIANT SLALOM SOUTH / SLALOM GEANT SUD
LADIES DOWNHILL / DESCENTE DAMES
SLALOM NORTH / SLALOM NORD
SLALOM SOUTH / SLALOM SUD
MENS DOWNHILL / DESCENTE HOMMES
Elevation / meters
Horizontal Distance / Longeur Distance / meters
Alberta
Ecosign

Olympic Course Profiles / Le Profil du Course Olympique

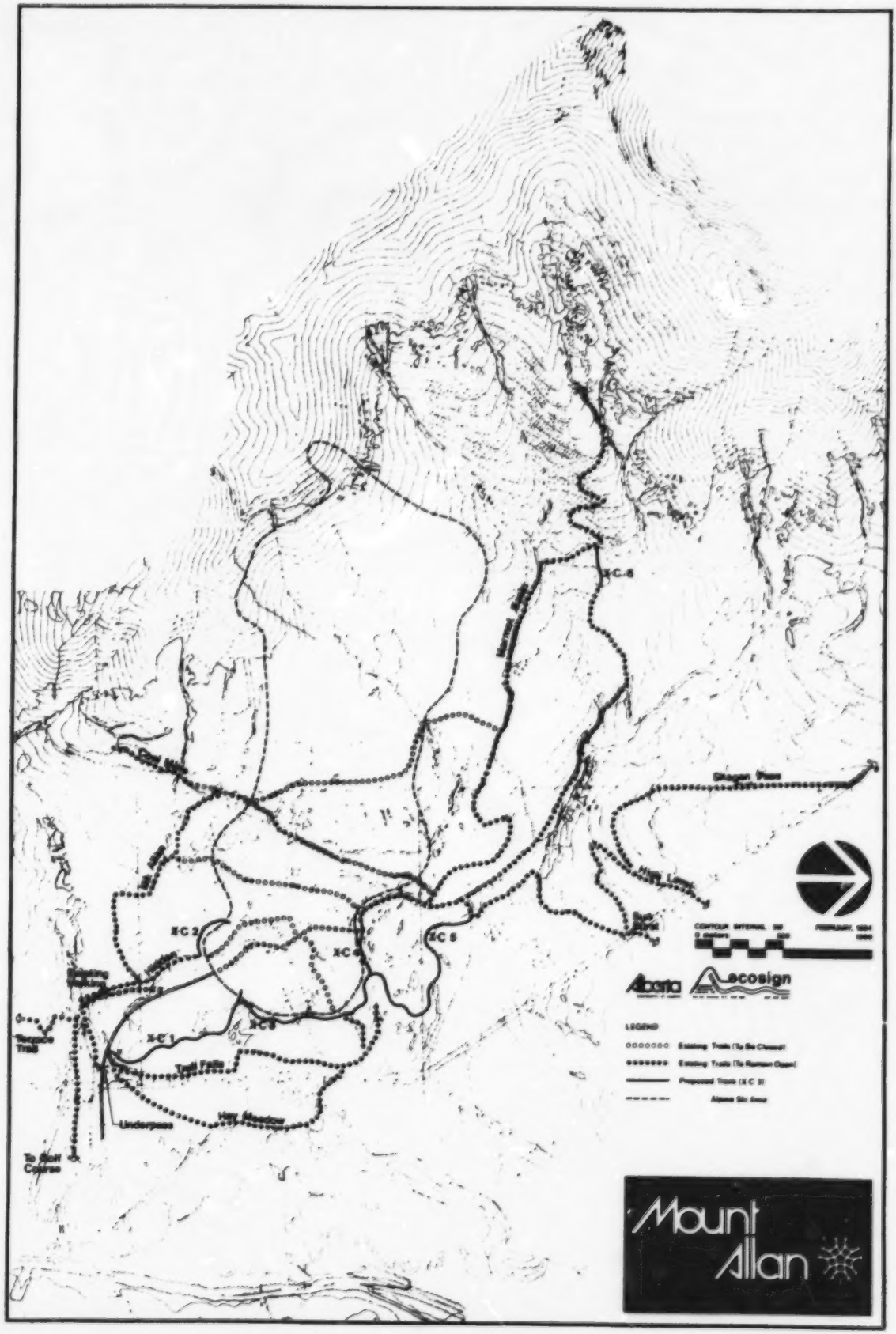
CROSS COUNTRY SKI TRAILS

A number of cross country ski trails exist on the lower slopes of Mt. Allan. The basic trail system was developed over 10 years ago and the system was upgraded as a part of the Kananaskis Country recreational program to provide approximately 40 kilometres of high standard, double track ski trail.

It was recognized at the start of the master plan process that certain trail systems would be affected by the proposed ski area development. Accordingly, a study was undertaken to identify which trails and linkages would be directly affected (i.e. closed) and which would be indirectly affected. Subsequent to this identification process, a serious effort was made to replace the "lost" cross country ski opportunities with equal or better trails in order to maintain and/or enhance the Ribbon Creek trail network. Of major importance was also retaining the existing linkages to other trail systems.

Approximately 6 kilometres of trails will have to be closed as a result of the proposed Mt. Allan development program. New trails will be developed to replace closed trails and/or to maintain required trail linkages. It is not expected that the quality of the nordic trails experience will be compromised in the Mt. Allan area; in fact it is hoped that new developments will enhance the experience. Figure 10 shows the existing and proposed cross country ski trail program in the vicinity of Mt. Allan.

The proximity of the proposed Mt. Allan day lodge to the cross country ski trail system will offer additional amenities and services to these skiers as well.



Cross-Country Ski Trails

CAPITAL COSTS

Preliminary cost estimates have been prepared on the basis of the conceptual development program outlined in the master plan. The recreational ski area, including primary infrastructure, is estimated to cost between $19 million and $20 million. The costs associated with upgrading base recreational ski facilities to Olympic competition standards, including permanent training facilities is estimated to be between $5 million and $5.5 million.

More precise cost estimates will be available once the project has advanced to the detailed design stage and pre-tender estimates can be prepared on specific project requirements.

OCO'88 will assume responsibility for all festival-specific costs associated with staging the alpine events in 1988.

IMPLEMENTATION STRATEGY AND SCHEDULE

Development of the Mt. Allan ski area is expected to take approximately 24 months to complete. The primary focus this year will be on general site preparation, the clearing of the ski runs and the construction and/or installation of primary infrastructure (i.e. power, water, sewer, access road). Detailed architectural design of the day lodge will be initiated immediately and it is expected that construction of the building can begin this year. The majority of construction will occur during 1985-86 and facilities will be available to host the mandatory pre-Olympic test competition in 1986-87.

Alberta Public Works, Supply & Services will assume primary responsibility for development of the site with the exception of the primary access road which will be constructed by Alberta Transportation.

The Alberta Government intends to use primarily private sector consultants and contractors in the implementation of the Mt. Allan project.

ENVIRONMENTAL PROTECTION PLAN

1. OVERVIEW:

The environmental protection plan addresses the impacts of ski area development and Olympic activity on the geophysical and biophysical systems of the proposed Mount Allan development area. The existing data base was sufficient in all areas except wildlife for the plan to be comprehensive in both scope and detail. Recommendations for obtaining additional information on specific species of wildlife have been included.

The key environmental concerns and corresponding mitigation measures are outlined below:

- Surficial Geology
- Hydrology
- Fisheries
- Wildlife
- Vegetation

Recommendations relating to the following subject areas are also included:

- Helicopters
- People Management
- Monitoring and Management

While the environmental protection plan has been prepared by independent consultants in response to the Ski Area Master Plan prepared by the Landplan Group, it is noteworthy that sensitive design to minimize potential environment impacts has been utilized as the major mitigative measure. As site specific environmental information was identified throughout the master planning process, the ski area design was compromised in deference to maintaining environmental quality. While most of the residual impacts can be mitigated, certain potential impacts, particularly for wildlife, lack sufficient information with which to justify detailed mitigative measures. The mitigation of environmental impacts will require a continuing commitment to be effective in the long term.

2. ENVIRONMENTAL CONCERNS & MITIGATIVE PROCEDURES:

a) Surficial Geology:

The south side of the gully near the top of the "A" Chair has been identified as an old slide area with possible high groundwater conditions. Three ski trails approach the north side of this gully and stripping of the forest cover may induce local instability. Although this problem is not considered serious, it is recommended that this area be investigated after snow melt so that guidelines on minimum setback of ski trails from the gully can be established.

The temporary men's downhill lift at the top of the "B" Chair is located on an active talus slope with rock bands being identified on the upper portion of the lift. Extreme care should be exercised during construction of this lift as the soils are in a state of limited equilibrium and should be subjected to an absolute minimum of disturbance. It is recommended that a geotechnical survey of the area be carried out prior to construction of the lift.

b) Hydrology:

It has been documented that no definitive changes in runoff have been detected for the Marmot Creek basin as a result of experimental logging activity. This cannot be regarded as positive evidence that changes will not occur as a result of the proposed ski development. There are two main reasons why an increase in runoff due to development may generally be expected.

1. While the overall extent of the forest removal for ski trails is similar to that for Cabin Creek and Twin Creek (relative to the drainage areas of the receiving streams), the pattern of clearcutting is radically different. The proposed runs and lifts will provide an interconnected network of cleared areas which almost exclusively run along steep slopes normal (perpendicular) to the contours. Timber harvesting in the Marmot Creek basin on the other hand avoided steep slopes and was confined to either separate large block cuts (Cabin Creek) or a honeycomb pattern of cuts (Twin Creek).

2. Machine snow will ensure that a snowpack is maintained on these cleared areas throughout the ski season. This will tend to diminish any impact of chinooks on the amount of snow held in the basin for the spring snowmelt period.

At present there is insufficient research available to determine the magnitude of any increase in runoff as a result of the ski development; however, the potential increase is not expected to cause any changes in natural drainage patterns (i.e. locations of major stress channels) because the existing channels are deeply entrenched in bedrock and bankfull capacities are generally in excess of normal peak flows.

Potentially high sediment yields can occur as a result of road construction and logging; however, in view of past experience in the Cabin Creek sub-basin, it is likely that the proposed ski development will not create serious erosion and/or sedimentation problems as long as soil disturbance is minimized and surface runoff is controlled.

The proposed ski runs cross streams in several locations, necessitating removal of stream bank vegetation. Bank vegetation helps to filter sediment from runoff and provides a major source of nutrients to oligotrophic mountain streams; thus, stream bank clearing must be avoided to the greatest extent possible.

If the following guidelines are implemented in conjunction with measures to revegetate disturbed areas following construction, as described in the master plan, erosion, sedimentation and deterioration of water quality in the Mount Allan area should be minimized.

1. Belts of undisturbed vegetation should be maintained wherever possible along drainage channels to prevent stream bank disturbance and sediment input into streams. Timber removed should be felled away from the stream channel to minimize damage. The buffer or filter belt of undisturbed vegetation will slow runoff, facilitate infiltration and filter out sediments. The width of the buffer will depend upon precipitation, vegetation, soils and slope steepness. A general rule is that buffer width should be 7.5 m for flat terrain and the width should increase 0.6 m for every 1 percent increase in slope steepness.

2. The key aspect of surface water control which must be emphasized is that runoff should not be allowed to concentrate on the ski runs. If this happens, gullying may occur and high rates of sediment production will result. To dissipate runoff, cross-drains should be constructed as required to channel runoff into undisturbed areas between runs where it can spread out as sheet flow. If possible the flow should be directed towards the nearest channel so that drainage does not cross adjacent ski runs.

3. Revegetation of disturbed areas should occur immediately following construction. Site specific investigations are needed to develop an effective and comprehensive revegetation program. The revegetation program should be developed in conjunction with Fish and Wildlife representatives to ensure compatibility of the plan with wildlife management objectives.

c) Fisheries:

Minor increases in streamflow and sediment loads are to be anticipated as a result of development and these effects may be largely mitigated by adherence to the water management guidelines outlined above. Furthermore, Gold and Silver Creeks are very small, intermittent streams with no fisheries resource capability and generally low potential for biotic productivity; therefore, it is expected that ski area development will not have a significant detrimental effect on water quality or stream biota during the initial development stage.

d) Wildlife:

It has been previously documented that the species of concern are bighorn sheep, elk and grizzly bear. While many species of wildlife inhabit the development area, it is unlikely that impacts arising from the development will be significant in terms of total populations or available habitat. The impact mitigation therefore focuses on bighorn sheep, elk and grizzly bear. The following is a summary of principal wildlife concerns with the order of presentation reflecting the degree of concern.

1. There is a need to confine activities and people within a prescribed area. While some aspects of elk and grizzly bear ecology will be in direct spatial conflict with the ski area development, the best habitat for sheep, elk and foraging areas of grizzly bear are not. The ridge line travelling southeasterwards from Mount Allan generally is the dividing line between the development area and areas with the best habitat capability. Some areas of excellent habitat exist on Mount Collembola at and above timberline. There may be a "contact zone" between wildlife and development activities and it is in this zone that significant impacts could occur, especially for sheep. For this reason, development activities, people and access should be confined, wherever possible, to below timberline to eliminate or minimize areas of overlap.

2. Helicopters:

   Helicopters will be used at different levels of intensity during all phases of the development. They represent potentially one of the most damaging sources of impact by the ease with which they may stray outside the development area. Sheep in particular are extremely sensitive to disturbance by helicopter and can quickly suffer severe effects by fleeing into areas where they are at risk or possibly by the physiological effects of the stress imparted, particularly at critical seasons. While helicopters during construction and in operational roles can be advised of the problem and mitigation procedures effectively exerted on their activities, more casual users (television, sightseers, etc.) are less manageable.

3. Ladies' Olympic Downhill Start:

   The Ladies' start area will be immediately adjacent to an area used by sheep in late winter/early spring (the most sensitive season) as well as throughout the winter (also very sensitive) and for escape terrain. In addition, a "catwalk" to be used for access from the "B" Chair to the Ladies' Downhill start will pass through a small portion of potential escape terrain. In response to concerns raised by the wildlife consultants, the planning team has substantially altered the catwalk and Ladies' Downhill start configuration to minimize this potential impact.

4. Men's Olympic Downhill Start:

   Whenever facilities are planned above timberline in Marmot Basin, they will come into the "contact zone" referred to previously. While the location of the Men's Olympic Downhill Start is above timberline, our current level of information indicates that it is of less concern than the Ladies' Olympic Downhill Start in that it will not occupy preferred habitat; however, a movement corridor of sheep has been identified along the ridge top of this location. There is therefore a potential for impact.

5. Timing of Construction:

   Construction activities at higher elevations (above 1,900 m) and particularly above treeline could cause serious impacts to wildlife populations during the critical winter/early spring time period.

   Mitigation measures are presented in relation to the scheduled issue or facility that they will affect. The prescribed measures are organized according to the planning and design, construction and operation of each of the following:

   Recreational Ski Area Development
   Olympics

<u>Master Plan Development:</u>

The initial development occurs below timberline and does not impinge upon critical winter habitat for bighorn sheep and elk. Construction activities and long-term operation of a ski area will have some peripheral impacts on wildlife populations. The following measures are proposed to mitigate impacts that may occur.

Planning and Design Phase:

1. A corridor development concept should be included in the planning for routes followed by lifts, snowmaking, power supply, communications and water and sewer pipelines wherever possible. This will minimize habitat disturbance.

2. All access routes to various facilities should be planned so as to eliminate or minimize the potential for further access to the southfacing slopes of Mount Allan, the mineral lick along Ribbon Creek and key late winter/early spring sheep range on the southeast face of the Mount Allan ridge.

3. A reclamation and revegetation plan should be developed with the principal objective of providing or restoring wildlife habitat and range as well as stabilizing slopes. Details of this plan should recognize and mitigate the potential for attracting ungulates to ski runs in summer and therefore potentialy compounding impacts in spring and fall.

4. An area within which all activities are to be confined should be adopted.

Construction:

1. Logs and slash should be removed from the development area so that they do not become an impediment to ungulate movements. Clearing operations should be conducted in order to minimize surface disturbance, protect wildlife range and mimimize the need for subsequent revegetation.

2. Pipelines for water and sewer should be coordinated so that trenching, lowering-in of pipe and backfilling are undertaken simultaneously. These measures will minimize impediments or hazards to ungulate movement.

3. Logging, clearing and construction activities should be timed so as to minimize effects in winter and spring. The preferred timing window is from June 15 to October 31. The Base Area need not be subject to this timing window; however, the need for timing constraints increases with elevation and is essential in the upper forested areas and above treeline. The Mid-Mountain area needs further evaluation in this regard. During construction, a wildlife monitor could assess the potential for impact and devise appropriate strategies for facilitating construction in the period outside the recommended timing window. Some key activities - such as elk rut - may or may not take place on site within the recommended time window for construction. This would also benefit from assessment by a wildlife monitor and on-site discussions with regard to impact mitigation.

4. Borrow areas should be recontoured and revegetated to mitigate against habitat loss.

Operation:

1. Snow fencing should be positioned with regard to avoiding ungulate movement corridors. At present, almost no information on movement corridors exists but would be developed if wildlife monitoring programs were instigated. Overlapping fences would provide gaps for ungulate passage; however increased snow depth may also prevent it.

2. Alternatives to salt use on the access roads should be investigated as it attracts ungulates and thereby causes conflicts.

3. Garbage should be removed from the site. Garbage receptacles should be bear-proof, complying with Kananaskis Country procedures.

Olympics:

The proposed start of the Men's Downhill and temporary lift to access the start area occur above treeline. The proposed start of the Ladies' Downhill and the catwalk trail leading to it are adjacent to critical winter and spring habitat for bighorn sheep and elk. The location of the Men's and Ladies' Downhills - as well as access to these trails, have been altered substantially in response to the wildlife habitat and escape terrain identified by the wildlife and vegetation consultants. It is noteworthy that the start area for the Ladies' Downhill has been lowered by 100 meters vertically so that the access catwalk can be constructed below the majority of the Bighorn sheep escape terrain. While sensitive design has been utilized as a mitigative measure throughout the Mount Allan master planning process, this movement of a major competitive event to mimimize potential conflicts with wildlife is a good example of mitigation being effectively achieved through the design process. The following measures and procedures are recommended to mitigate any residual impacts.

Planning and Design:

1. Due to the fact that the Men's Downhill start facility and upper run must be placed above timberline to achieve the necessary vertical drop, the option for moving the start below the tinmberline does not exist; therefore, the potential for a residual (non-mitigable) impact exists here. Measures to reduce the impact are noted in the Operation section below.

2. The options of locating the start of the Ladies' Downhill further down the slopes or of relocating it to another trail should be seriously considered. At the least, all facilities associated with the start area should be placed below the crest of the ridge.

Construction:

1. Construct the Men's Downhill start between June 15 and October 31.

2. Construct the Ladies' Downhill start between June 15 and October 31, including logging and clearing.

3. Maintain forest cover adjacent to the Ladies' Downhill wherever possible to act as a visual screen.

4. Minimize surface disturbance and revegetate to species suitable to wildlife where disturbance is unavoidable. Remove all cut timber from the mountain.

5. Restrict ground activities to below the ridge crest on the north side and contain all activities and access within the boundaries of Marmot Basin.

Operation:

1. Use the Men's Downhill start for competitions only.

2. Use the Ladies' Downhill start up to 1988 Olympic events only. The wildlife consultants recommend that use of the start area be discontinued after the Olympics. If this is not feasible, use the Ladies' Downhill start for competitions only.

3. Restrict access to the start areas to authorized personnel only (no spectators) to minimize the activity in the area.

4. Safety netting should be installed immediately prior to the Olympics or competitive events and removed immediately thereafter.

5. If Olympic security arrangements require use of aircraft or activities outside the development area, they should be planned with input from a wildlife specialist as such activities could have significant detrimental impacts during the critical winter period.

Helicopters:

1. Helicopter flights should be restricted to certain approaches and routes. A corridor within Marmot Basin below the crest of the ridge should be used for all approaches to higher elevations. The corridor should stay below the timberline (where feasible) to approach upper elevations. In general, the activities should be confined wherever possible north of the proposed Ladies' downhill run, particularly between November 1 and June 14.

2. General approaches to the development area by project-related helicopters should follow the Kananaskis Highway, not overflying Wind Ridge and the area intervening between Wind Ridge and Mount Allan, and definitely not over winter ranges on the south slopes of Mount Allan.

3. Special attention should be paid during the Olympics to prevent television or press crews from straying outside the designated areas in helicopters. A briefing session should be arranged to ensure the cooperation of all parties.

People Management:

The ski area should be developed incorporating the framework for managing access and activity patterns of skiers. The following points are important considerations in minimizing or avoiding impacts on wildlife.

1. As expansion of the skiing development to include other uses is possible, comprehensive recreational (including hunting) concepts and policies should be developed for the facility and its environs as a special case in Kananaskis Country. In order to mimimize impacts on sheep and elk, it may be advisable to undertake a program of neutral habituation to downhill skiing and ancillary recreation. This may not be possible if hunting continues. The objective of concept and policy development should be to compromise between maintaining the integrity and visability of the ungulates in a recreational area on one hand and maintaining the ungulates as a hunting resource on the other. There is already an overlap between hunting seasons and the time when the facility is likely to be operational or at least making snow.

2. Information on bears and bear hazards should be available during operation and maintenance.

3. Feeding of wildlife should be prohibited.

4. Litter facilities should be provided wherever concentrations of construction workers, skiers or spectators are anticipated.

e) Vegetation:

Nine species of rare plants are found on Mount Allan. Four of these are not in danger of serious losses because of their local abundance. The other five are endangered species but occur only in the alpine zones above timberline. As ski area development is located below timberline with the exception of the start of the Men's Downhill, only minor and localized disturbances are anticipated. Endangered species should be located as to specific occurrences on Mount Allan and protected from disturbance.

3. MONITORING & MANAGEMENT

The success of the environmental protection plan will largely depend upon its implementation. Many of the measures recommended are procedural. In order to ensure success, an on-site program will be developed to advise planners, designers, engineers, construction workers and operators on the day-to-day implementation of the plan and to provide the potential for day-to-day decision-making on impact mitigation.

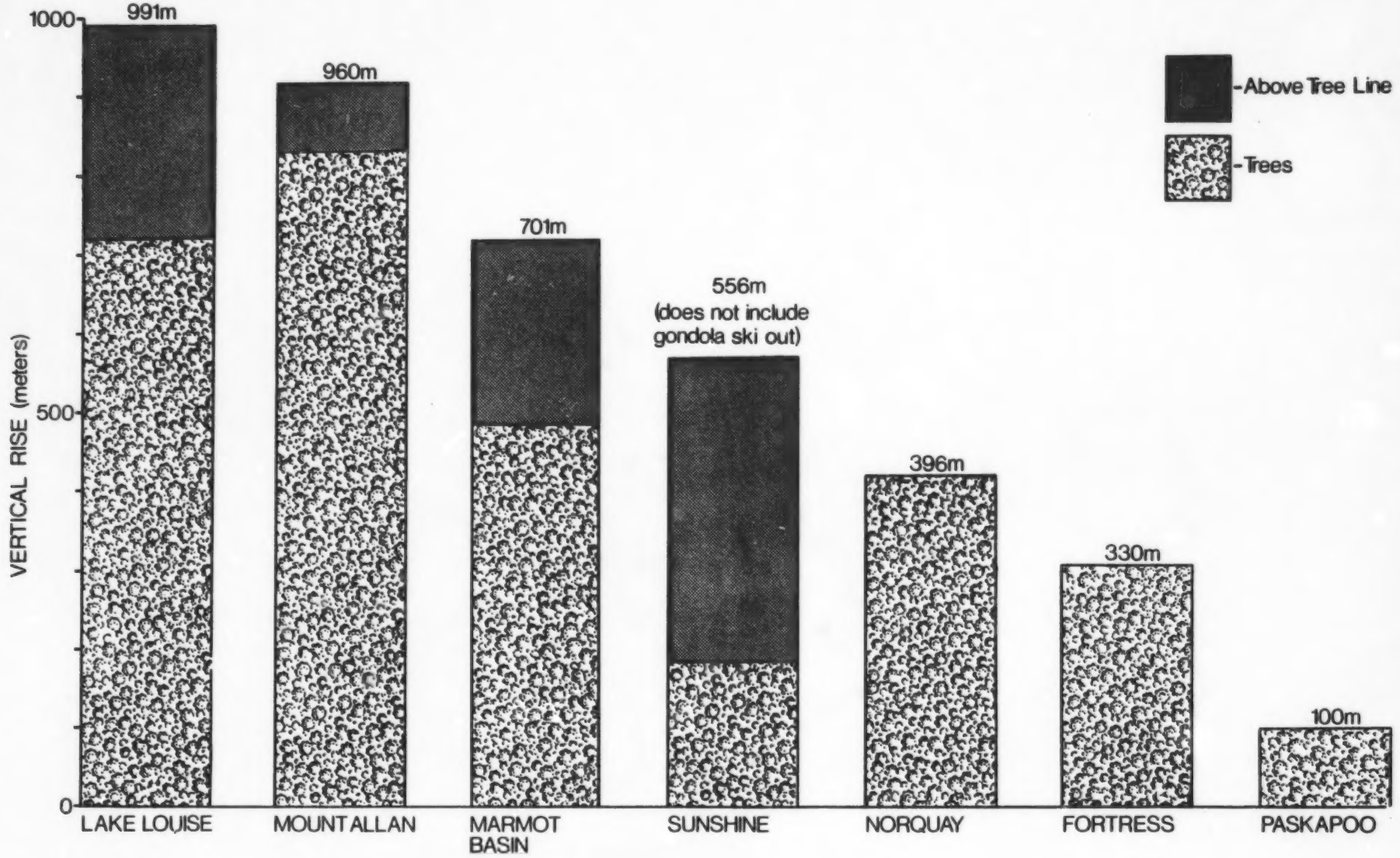
An ongoing monitoring study should also commence immediately and continue into the post-Olympic period. The monitoring program will provide needed information in several areas.

1. Changes in run-off and sediment yield due to ski area development and the use of machine snow.

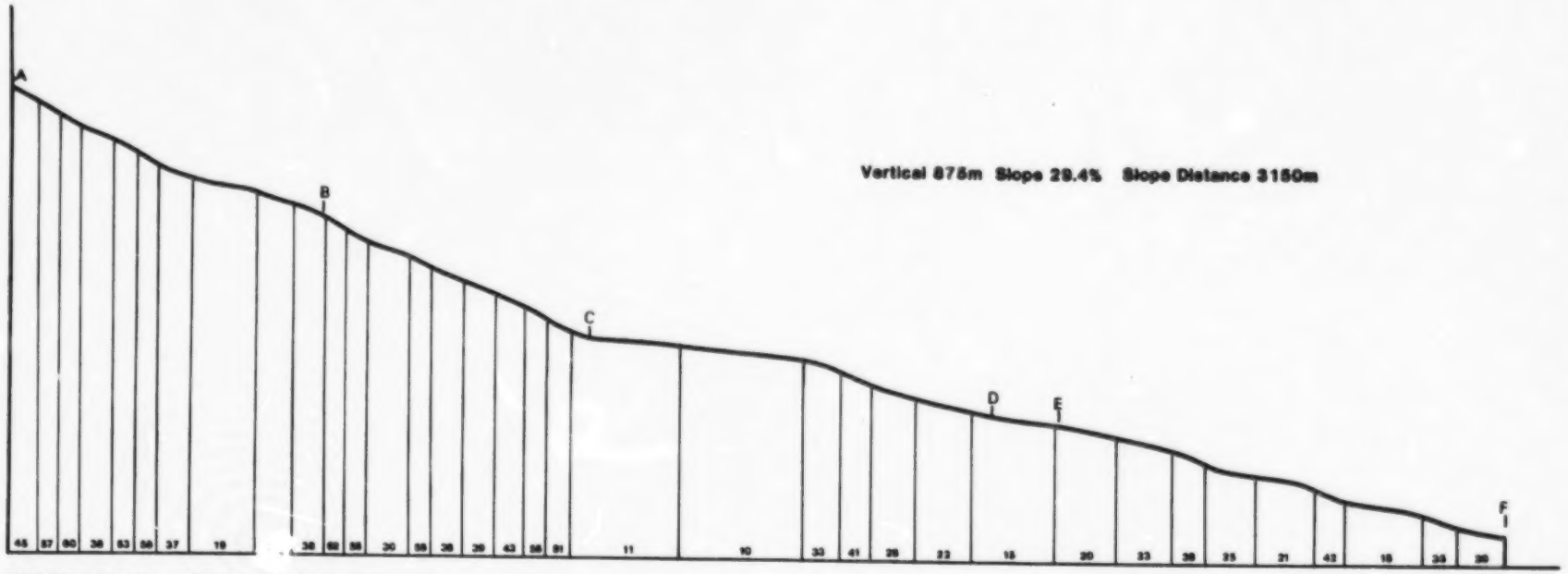
2. Wildlife data for the species of concern relating to seasonal distributions; movement corridors; calving, lambing and rutting areas; mineral licks; and the sex and age structure of specie populations.

3. The need to employ additional impact mitigation techniques during construction and operation.

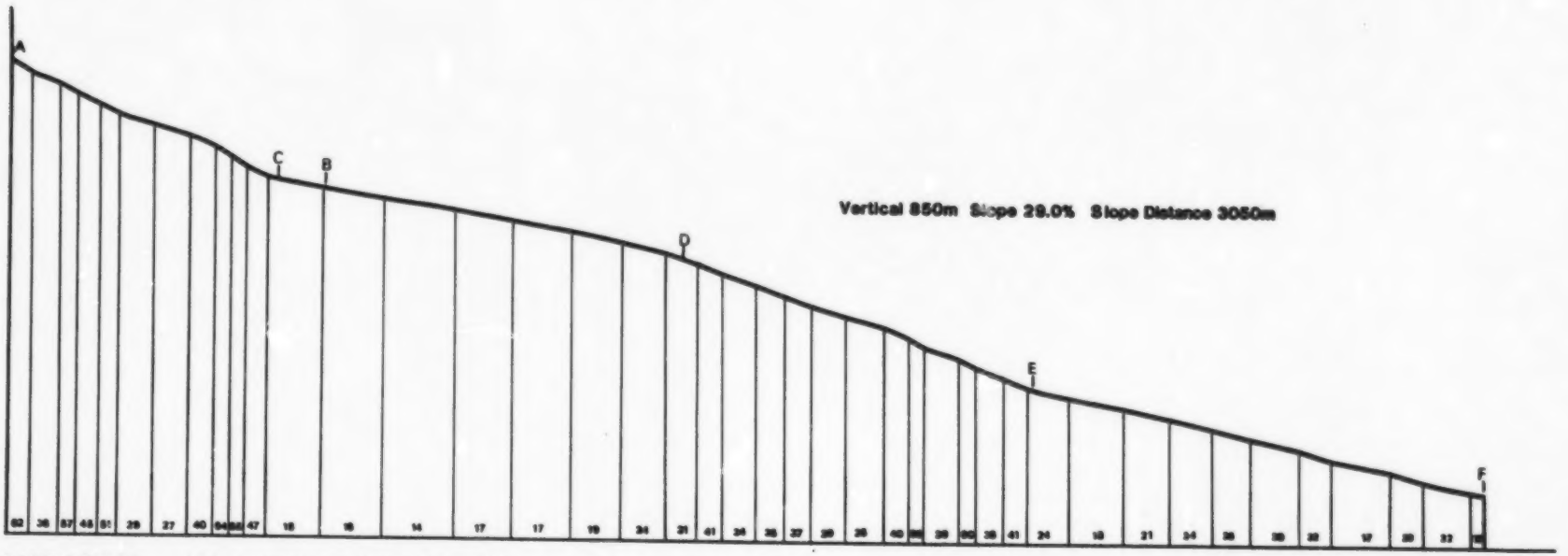
The information derived from the monitoring study will prove invaluable in establishing operating procedures for the development and in the design and construction of future phases. The study will also provide a broad base of environmental management knowledge that can be applied to the planning of similar projects throughout the province.



ALBERTA VERTICAL RISE COMPARISON



MOUNT ALLAN **Proposed Men's Downhill**



LAKE LOUISE **1983 World Cup Men's Downhill**